Closed-loop medicines management system

Fully integrated, computerised medication management has the potential to improve safety and save nursing time. This article looks at the ServeRX system, which is in place at pilot sites in Israel, Europe and the USA

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Thousands of patients die or are seriously harmed each year from errors in the medicines management process. These errors cause deep human suffering and are a huge financial burden on healthcare systems. Many are preventable. In the USA a preventable adverse drug event will, on average, lengthen a patient's stay in hospital by 2.2 days at a cost of $4,684.[1]

MDG Medical Ltd (Tel Aviv, Israel), has designed, patented, tested, and field-validated the ServeRx system – a state-of-the-art fully computerised, integrated medication management system that is complete, simple, flexible and affordable. It offers the prospect of increased safety and lower costs to the majority of healthcare systems. ServeRx is a decentralised (ward-based) closed-loop medicines management system that controls the whole patient medication process from the prescribing through dispensing and verification to administration and event logging.

ServeRx can stand-alone or be fully integrated into a hospital's information systems and it can be integrated into a centralised or decentralised pharmacy. It can be rolled out ward-by-ward or installed in nursing homes and minimum care establishments.

ServeRx comprises computerised physician order entry (CPOE) software with handheld notepad computers, medication administration software with ward-based workstations, computerised medication/dispensing cabinets and mobile computerised medicine trolleys. Barcode verification ensures that the nurse administers the correct medication to the right patient.

The closed-loop medicines management process begins with the doctor entering the prescriptions in the notepad computer via a touch screen. Decision support software is available along with patient specific information such as height, weight, allergies, current medication and, if required, graphical displays of the patient's vital signs and certain laboratory results. At the end of the prescribing round, prescriptions are downloaded to the ward-based workstation and also to the pharmacy. The clinical pharmacist can, at this stage, review the prescription details.

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The ward-based workstation manages the medicines administration process as well as controlling the ward inventory. Ward stock is maintained at agreed levels through an electronic link to the centralised pharmacy system that may include an automated medicines distribution robot. An important feature is the scheduling and charting tool, which enables the nurse to plan and record electronically medicines administration.

The computerised cabinet assists the nurses in the preparation and control of all patient medication. Displaying the patient's medication order list and releasing the appropriate drawers one at a time reduce the risk of wrong medicine selection. Special configuration of the workstation enables controlled drugs, refrigerated medicines and bulk IV fluids to be stored in the same location. Medicines are transferred, in a safe and efficient way, from the workstation to patient-specific drawers in the medicine trolley which is docked to the workstation, controlled at all times by the unique software.

The medicine trolley (smart cart) links the nursing station to the bedside, thereby closing the loop. This trolley offers a safe, computerised medicine administration system that guides the nurse through the process. The integrated touch screen and barcode reader verifies the patient's identity. A single patient-specific drawer, identified by an LCD patient name on the front of the drawer, opens only after correct patient identification. An electronic record of the medicines administration is generated. At the end of the round the trolley is returned to the workstation and the data is transmitted back to the main file.

Barcoding has been proven to deliver fundamental advantages to healthcare. Most importantly, through barcoding of patient identification bands, caregiver badges and medications, barcode systems are able to reduce medication errors by 65–86%.[2–4]

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The barcode reader offers exceptional accuracy and speed of information collection. Tests have shown that barcode scanning has an error rate of 1 in 10,000,000 characters compared with keyboard entry of 1 in 100 characters.[5]

The first pilot site in a ward consisting of 36 beds at the Sheba Medical Centre, Tel Hashomer Hospital in Israel has been running for almost one year. A prospective comparative intervention study with post intervention measurements on 204 patients has been carried out by Dr Ahuva Weiss-Meilik, Head of the Performance and Outcome Improvement Unit. Data collection consisted of:

- Timing the process (total segments) measured by time (minutes), from medication preparation to delivery.
- Potential for error incidence.
- Process variation among staff members.
- Process complexity, measured by the number of process steps.
- Ergonomics and ease of use, measured by the number of process steps.
- Ergonomics and ease of use, measured by staff satisfaction.

Some data is still being processed, and observations are still underway. The learning curve effects were not adjusted for the study results. Key findings available are divided into time related and safety measurements.

- The time-related measurements show that the overall nursing time for the medication workflow has decreased by 6.1 hours per 24-hour shift.
- The safety issues observed in the study were strengthened in most cases in comparison to the baseline.

Ergonomics and ease of use ("staff satisfaction"), inventory management and final updating of the data will be available by the end of the year.

Two additional pilot projects, one in Europe and the other in the USA have been established. The European pilot site is located on a 28-bed general surgery ward at Charing Cross Hospital, London (part of Hammersmith Hospitals NHS Trust). Professor Nick Barber and his team from the School of Pharmacy in London are carrying out a full evaluation of the system and will report towards the end of the year. Ms Ann Jacklin, Chief Pharmacist at the Hammersmith Hospitals NHS Trust, the UK pilot site for ServeRx, is confident that the electronic prescribing system will identify in real time prescription changes, thus assisting pharmacists to target their clinical activities in a more effective way.

The American pilot site is being established at the step down unit, a 16-bed unit at the Richmond Heights Hospital, part of the University Hospital Health Systems in Cleveland Ohio.

It is anticipated that ServeRx will promote better medicines management by reducing medication errors, reducing inventory on the wards and reducing nursing time for medicines administration. ■

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